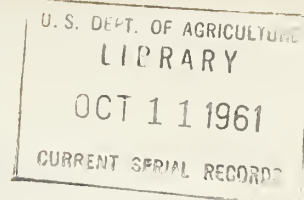


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CHEMICAL QUALITY, FEEDING VALUE, AND STORAGE LOSSES
OF ORCHARDGRASS SILAGE AS AFFECTED BY NITROGEN FERTILIZATION

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The use of nitrogen fertilizer has become a widely accepted method of increasing both yield and protein content of grass forages. An increase has been observed in digestible energy as well as digestible protein of grass hays as the rates of nitrogen fertilizer have increased. The work reported in this paper was initiated to determine the effect of nitrogen fertilization on chemical quality, preservation and feeding value of grass silage.

Experimental Procedure

First cutting orchardgrass, untreated (ON) or receiving 400 lbs. per acre of ammonium nitrate (+N) on April 19, 1960, was direct-cut harvested May 5-6 as heads were emerging from the boot and stored in two 10' X 35' upright silos. Each silo was sealed with polyethylene sheets weighted with approximately 1 ton of chopped forage.

All stored materials and the resulting silages and seepages were weighed and sampled for chemical analysis. Silage temperatures were measured by thermocouples located in the center of the silos at about 2.5, 8.5, 14.5, and 20.5 feet above the silo floor.

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The silos were opened and feeding commenced after 5 months' storage. The silages were sampled daily as they were fed. Fresh 5-day composite samples were analyzed for dry matter (toluene distillation), pH, sugar, crude protein, ammoniacal nitrogen and organic acids. Dried 20-day composites were analyzed for the remaining proximate constituents.

Feeding values were estimated with two groups of four cows during 120 day switch-back feeding trial of three 40-day periods. The ration consisted of silage fed ad libitum and grain fed initially on an individually based grain:FCM ratio of 1:5. Changes in grain feeding every ten days thereafter were based on the percent decline in FCM production of the entire group.

Dry matter digestibility was determined near the end of the trial by the total collection method, using two groups of three wether sheep in a cross-over trial of 10 days preliminary and 5 days experimental.

Results and Discussion

Average initial and final chemical composition of the silages are presented in Table 1. The application of the nitrogen 15 days prior to harvest resulted in a marked increase of about 69% in the crude protein, some reduction in NFE and dry matter and little change in the other constituents of the forage prior to ensiling.

The average daily temperature of the +N silage reached a peak of 90° F. 4 days after storage and gradually declined to maintain an 84° F. temperature after 30 days of storage. The ON silage reached a peak of 87° F. 8 days after storage and declined more rapidly becoming relatively stable at 79° F. 20 days after storage.

Storage effects on the forage constituents were typical of high-moisture forage fermentation. The treatment differences in initial composition remained after storage.

The chemical quality of the +N silages as judged by present standards was very inferior since values for pH, butyric acid, and ammoniacal nitrogen were markedly high while lactic acid content was relatively low. The excellent chemical quality, mild odor, and light green color of the ON silage were indicative of a good fermentation that produced a good quality silage.

TABLE 1.--Average chemical composition of forages and silages and percentage of stored nutrients preserved for feeding

Components	% Composition				% Recovered	
	Forage Stored		Silage Fed			
	ON	+N	ON	+N	ON	+N
Dry matter	22.9	21.3	25.7	24.0	84.8	78.4
Crude protein	14.4	24.3	14.1	25.2	83.1	81.1
Ether extract	3.6	3.4	4.7	5.3	110.6	124.1
Crude fiber	25.9	24.2	30.4	28.3	99.8	92.0
N.F.E.	48.0	40.1	43.0	32.9	76.0	64.4
Ash	8.0	8.0	7.7	8.3	81.5	80.6
Sugar			1.1	.2		
pH			4.0**	5.0**		
Ammoniacal Nit.			1.1**	5.5**		
Butyric acid			.2**	2.2**		
Propionic acid			.1**	.6**		
Acetic acid			4.9**	2.4**		
Lactic acid			9.0**	4.5**		
Ammon. nit. as % of protein			7.7**	21.7**		

** Differences in means significant at 1-percent level of probability.

Dry matter was more efficiently preserved in ON silage than in the +N silage (Table 1). The greater efficiency resulted from lower seepage and invisible loss in the ON silage (Table 2). Spoilage losses were nearly eliminated in both silages by the sealing method used.

TABLE 2.--Distribution of dry matter losses

Silage	Spoilage	Seepage	Invisible	Total
ON	0.1	8.7	6.3	15.1
+N	.4	11.8	9.3	21.5

Feeding trial results are presented in Table 3. Both silages were markedly similar in feeding value as measured by dry-matter acceptability, milk production, liveweight changes and TDN and dry matter digestibility determinations.

The lack of differential in feeding value of these two silages, which were so different in composition, chemical quality, odor and appearance, is contrary to most popular concepts concerning the relative importance of these factors to the feeding value of silage. While such criteria as pH, acid ratios, and ammonia content may be useful guides in silage made from crops of usual chemical composition, the present results suggest that in silages made from forage of high nitrogen content, such criteria may be less useful.

Summary

A direct comparison was made of storage losses, chemical quality and feeding value of first cutting orchardgrass direct-cut harvested as ON (untreated) and +N (400 lb./acre of ammonium nitrate) forage stored in two upright silos.

Under conditions of this experiment, the application of nitrogen to orchardgrass 15 days prior to harvest resulted in a forage and silage high in protein and of decidedly inferior quality as judged by present standards of physical and chemical characteristics. The marked inequality of these silages could not be demonstrated in feeding and digestion trials where treatment differences were small and nonsignificant.

TABLE 3.--Results of feeding and digestibility trial

Items Compared	ON	+N
Feed dry matter consumed (lbs./cow/day)		
Silage	24.56	24.27
Concentrate	5.79	5.70
Total	30.35	29.97
(lbs./cwt./day)		
Silage	2.01	1.97
Concentrate	.46	.48
Total	2.47	2.45
Milk production FCM per cow		
Average per day	28.80	29.43
10 day regression ^a (lbs.)	-.46	-1.24
Ratio Grain:FCM	1:5.0	1:5.2
Liveweight per cow (lbs.)		
Average	1227	1235
10 day regression ^a	13.1	10.3
Calculated feeding value		
Total Daily Requirements (lbs. TDN)	23.30	22.57
Concentrate value (lbs. TDN)	4.86	4.79
Required from silage (lbs. TDN)	18.44	17.78
TDN content of silage D.M. (%)	75.1	73.3
Determined feeding value of silage		
TDN in dry matter (%)	70.3	72.2
Dry matter digestibility	71.0	71.8
Feeding potential		
Feedable TDN/day (lb.)	17.3	17.5

^a Regression ending 20, 30, 40 days on each ration.



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